

Chocolate Festival

Brief Overview:

In this tasty unit students will be exposed to the statistical concepts of mean, median, mode, and range. Though a variety of hands-on experiments involving chocolate, students will collect, analyze, and organize data into line plots, bar graphs, and stem and leaf plots. Students will learn how to design their own surveys to represent their data in graph form.

NCTM Content Standard:

Formulate questions that can be addressed with data and collect, organize, and display relevant data to answer them.

- **Design investigations to address a question and consider how data-collection methods affect the nature of the data set**
- **Collect data using observations, surveys, and experiments**
- **Represent data using tables and graphs such as line plots, bar graphs, and stem and leaf plots**

Grade/Level:

Grades 4-5

Duration/Length:

Three lessons – 60 minutes per lesson

Student Outcomes:

Maryland Voluntary State Curriculum

Standard 4.0 Knowledge of Statistics

A. Data Displays

1. a-c: Students will collect data by conducting surveys to answer a question in order to organize and display data in line plots, bar graphs, and stem and leaf plots

B. Data Analysis

1. a-b: Students will interpret and compare data in stem and leaf plots, line plots, and bar graphs in order to show mastery of information contained in the graphs.

C. Data Analysis

2. a-b: Students will determine the mean, median, mode, and range of a set of data in order to interpret the information contained in the graphs.

Materials and Resources:

- Assorted chocolate bars
- **The Chocolate Touch** by Patrick Skene Catling
- Small bags
- Data Analysis Sheet
- Word Problem Preassessment
- Hershey Kisses
- Ruler/measuring tape
- Kiss Slide Sheet
- Construction paper for vocabulary flip chart
- Chocolate Chips in assorted flavors (Example: milk chocolate, butterscotch, white chocolate, mint)
- Graph paper
- Blank white paper
- Summative assessment

Development/Procedures:

Lesson 1

Pre-Assessment -

- Students will receive a completed line plot, Student Resource 1, with questions addressing the mode, median, mean, range, and other questions related to the features of a line plot. Answers can be found on Teacher Resource 1.

Launch-

- Conduct an interactive read aloud of **The Chocolate Touch** by Patrick Skene Catling introducing students to the many possible varieties and diverse forms of chocolate.
- Informally assess of student dialogue based on math-related analysis of the events in the story.

Teacher Facilitation -

- Introduce and model concept of conducting a survey to find measurable data.
- Assemble small bags of four assorted mini chocolate bars.
- Model the taste survey of individual candy bars by rating each one and showing the results on a transparency version

of the data analysis sheet (Chocolate Taste Survey),
Student Resource 2.

- Distribute a bag and data analysis sheet to each student.

Student Application - Students will begin individual survey process of
chocolate bar ratings.

- Students will sample each chocolate bar individually.
- Students will record their opinion of each candy bar on the data analysis sheet along a continuum of 1-10.
- Students will come together as a whole group with teacher facilitation to collect and compile data into one line plot per candy bar.
- In whole group with teacher facilitation students will determine the mode, range, and median of the class data for each candy bar.
- Students will record their favorite candy bar on the Data Analysis Sheet and make a line plot using the class data for that candy bar.
- Create a table on a transparency to collect student data on favorite candy bar type.
- Based on the collected class data students will make a bar graph, Student Resource 3, representing the class data on favorite candy bar.

Embedded Assessment -

- The teacher will informally assess the students' understanding and progression towards mastery through informal observation during student application time and successful completion of their line plots.

Reteaching/Extension -

- **Extension Activity:** Students that have shown mastery of the skills incorporated in the lesson will work individually to display the data in a bar graph.

Reteaching Activity:

- **Students that have shown difficulty with mastery of the lesson's skills will meet in a small group with the teacher in order to participate in reinforcement activities related to analyzing data to create a bar graph.**

Lesson 2

Pre-Assessment -

- **Students will be presented with a word problem to find the average of five test scores in order to preassess the students' prior knowledge of finding the mean, Student Resource 4. Answers can be found on Teacher Resource 2.**

Launch -

- **Students will Think-Pair-Share their possible solution with a shoulder partner. Circulate and listen to student responses during the share time. Next, call on volunteers to demonstrate how they attempted to solve the problem. Clarify possible misconceptions about how to find the mean of a set of numbers.**

Teacher Facilitation -

Introduce and model concept of determining the mean through experimentation.

- **Explain that finding the average and the mean is the same process. Mean, median, and mode are all measures of center. Average is commonly used to refer to the arithmetic average.**

Outline relevant vocabulary to create a four-word flip chart defining the meaning of: range, mean, median, and mode.

Refer to Teacher Resource 3 for a more detailed explanation.

- **Explain the chocolate experiment and objective of the lesson.**

- **Model the Kiss Slide experiment and collect Kiss measurements in centimeters.**
- **Distribute materials: One Hershey Kiss, one ruler/tape measure, one Kiss Slide sheet, Student Resource 5, per student.**
- **Students will select a partner to work with. Partner pairs will be responsible for collecting 20 pieces of data.**

Student Application - Students will begin Kiss Slide experiments and record their data in order to determine the mean upon completion.

- **Partner pairs take their supplies to a flat surface (floor, table, etc) and begin their sliding.**
- **Students will measure the length of their slide in centimeters.**
- **Students will record the length of their slide, to the nearest centimeter, on their Kiss Slide sheet.**
- **Students return to a whole group setting. Facilitate data collection and model finding the mean of a set of data.**
- **Student partner pairs will then determine the mean of their own data on their Kiss Slide sheet.**
- **Student groups report the mean of their data set while you record the information on a transparency.**

Embedded Assessment -

- **The teacher will informally assess the students' understanding and mastery of determining the mean through informal observation during student Kiss Slide time and successful computation of the mean of their data.**

Reteaching/Extension -

- **Extension Activity-Students who displayed mastery during the student application time will work in their partner pairs to determine the overall mean of class' data.**

Reteaching Activity-

- **Students who had a difficult time with the concepts incorporated in the student activity time will work in a teacher-facilitated small group in order to determine the mean of the class' data.**

Lesson 3

Pre-Assessment -

- **Teacher will give students a reinforcement assessment on the concepts covered during the previous two lessons by giving students numbers to determine the mean, median, mode, and range.**

Launch -

- **Divide students into partner pairs and distribute a completed copy of a line plot, bar graph, and stem and leaf plot (Graph Analysis Sheet), Student Resource 6.**
- **Students will respond and discuss with their partner questions relating to the elements of the graphs. For example: "What is the title of this graph? "How might this graph be used?"**
- **Direct student attention to the stem and leaf plot.**
- **Partners will generate possible ideas for how to interpret and analyze the information in the stem and leaf plot.**

Teacher Facilitation: Clarify misconceptions about stem and leaf plots and how to correctly organize data based on the accepted structure of a stem and leaf plot.

- **Call on students to share their hypotheses about the use and interpretation of the stem and leaf plot.**
- **Survey the class in order to collect data for a "How Old Is Your Mom?" stem and leaf plot. Refer to Teacher Resource 4 for a detailed explanation. On a transparency organize the data and construct a stem and leaf plot.**

- Reinforce the structural features of the stem and leaf plot, such as stems equal tens places and leaves equal ones place.
- Pour several bags of assorted types of chocolate chips into a large plastic container. (Example: milk chocolate, white chocolate, butterscotch, mint.)
- Introduce the experiment and model the appropriate procedures for completing the activity.

Student Application - Students will gather data through a hands-on activity where they will later construct stem and leaf plots and bar graphs.

- Circulate around the classroom allowing each child one opportunity to get as large a handful of chocolate chips as possible.
- Students will count how many total chocolate chips they were able to grab.
- Students will report the total number of chocolate chips they were able to grab while you record the data in a table on the transparency.
- Distribute stem and leaf plot sheets, Student Resource 7, so each student can create a stem and leaf plot.
- Create and model a stem and leaf plot on a transparency with student input, while students work individually at their seats on their stem and leaf plot.
- Instruct the class to divide their chocolate chips into categories based on the individual flavors.
- Students will receive graph paper and create individual bar graphs based on the chocolate chip categories using the chocolate chips as marking chips for the bar graphs.
- Students will glue chocolate chips onto the bar graph and label graphs.

Embedded Assessment -

- Informally assess the students' understanding and mastery of constructing stem and leaf plots through informal observation during student exploration activity time and successful completion of their graphs.

Reteaching/Extension -

Extension Activity-

- **Students will self select a survey topic in order to collect and organize data in order to create a graph of their choice. (Line plot, bar graph, stem and leaf plot.)**
- **The class will brainstorm possible survey topics such as: favorite pizza toppings, results of a taste test, measurement experiments, etc.**
- **Students will be given a piece of large construction paper in order to show their survey results in a graph format.**
- **Students will be given 1-2 days to complete this project.**

Reteaching Activity:

- **Students who have shown difficulty mastering the concepts introduced in the past three lessons will receive targeted reinforcement in a small group instructional setting.**
- **Concepts such as mean, median, mode, range, and the different types of graphs will be reviewed in the following school days.**

Summative Assessment:

Students will take an assessment (Student Resource 8) consisting of three selected response questions and one brief constructed response. The questions will cover concepts taught: bar graphs, line plots, stem and leaf plots, and median and will be used to measure students' progress towards mastery of the covered topics. Answers can be found on Teacher Resource 5.

Authors:

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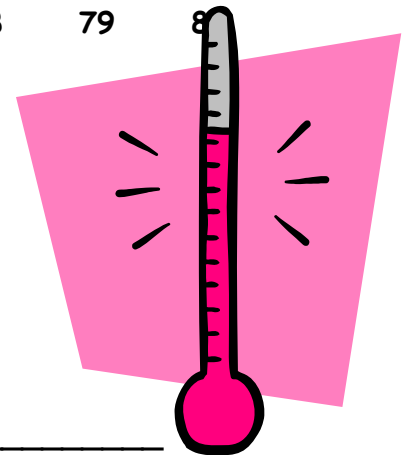
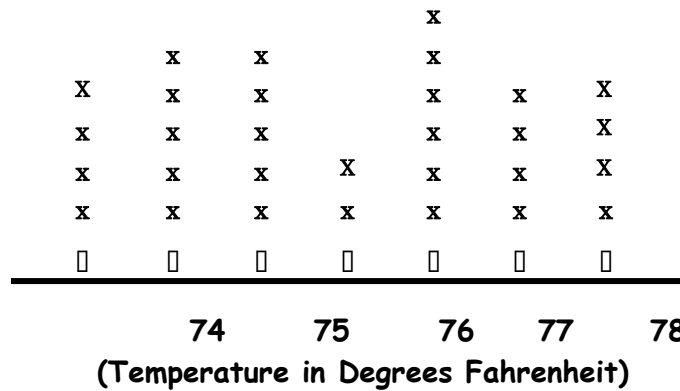
**Matthew Reif
Calverton Elementary School
Prince George's County, MD**

Name _____

Date _____

DIRECTIONS: Examine the line plot below. Interpret the data and answer the questions below.

Temperature for the Month of September



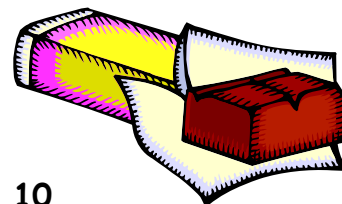
1. Identify the range. _____
2. Identify the mode. _____
3. Identify the median. _____
4. What is the title of this line plot? _____
5. What are the units of measurement? _____

Name _____

Date _____

Chocolate Taste Survey

DIRECTIONS: Rate the taste of each candy bar on a scale of 1-10 (1=worst, 10=best). Gather data below.



Sample 1: Hershey's Milk Chocolate

1 2 3 4 5 6 7 8 9 10

Sample 2: Krackle Bar

1 2 3 4 5 6 7 8 9 10

Sample 3: Hershey's Special Dark Chocolate

1 2 3 4 5 6 7 8 9 10

Sample 4: Mr. Goodbar

1 2 3 4 5 6 7 8 9 10

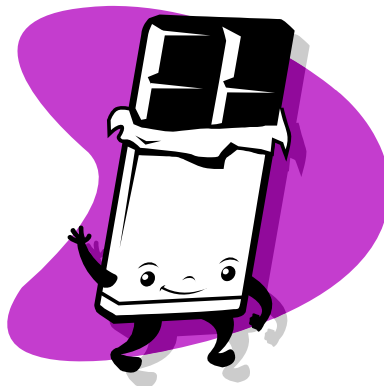
I rated _____ as my favorite.

Personal Line plot of my favorite Chocolate:

Chocolate Taste Survey

DIRECTIONS: Create a class bar graph based on the data collected with your classmates' favorite type of chocolate bars.

(Reminder: Make sure your graph has all the essential elements!)

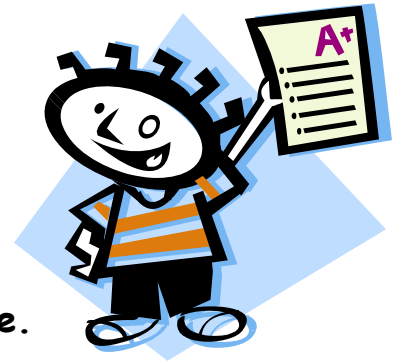


Name _____

Date _____

DIRECTIONS: Read the word problem below and answer in the space provided.

Your teacher is trying to figure out your final grade for math class this quarter. You have five assignments scored in the teacher's grade book. You have received a 94, 82, 100, 71, and 88 as your grades. Find the *mean* of these scores to determine your final math grade.



Workspace

Letter Grade Key

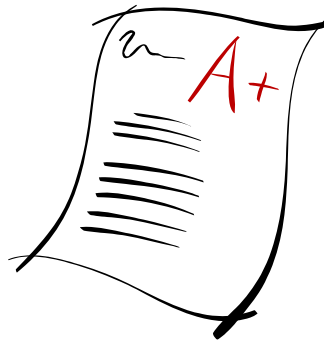
A= 100-90

B= 80-89

C= 70-79

D= 65-70

E= below 65



Conditional Extension:

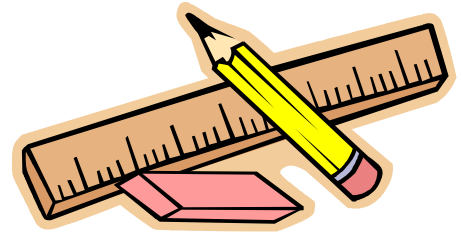
If the teacher dropped the lowest grade, what would the new *mean* be?
Would the final letter grade change?

Name _____

Date _____

Kiss Slide Experiment

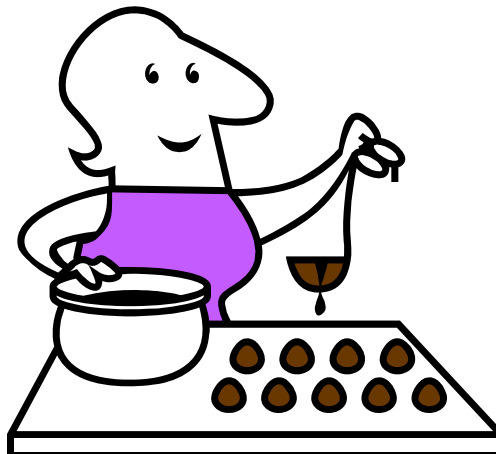
DIRECTIONS: With a partner, conduct Kiss Slide experiment by measuring the length (in centimeters) that a Kiss can travel on its flat surface. Establish a starting line, and measure from starting line to furthest point of distance. Conduct experiment 20 times, and collect data below.



Partner 1:

Partner 2:

Attempts	Distance (cm)	Attempts	Distance (cm)
1		11	
2		12	
3		13	
4		14	
5		15	
6		16	
7		17	
8		18	
9		19	
10		20	



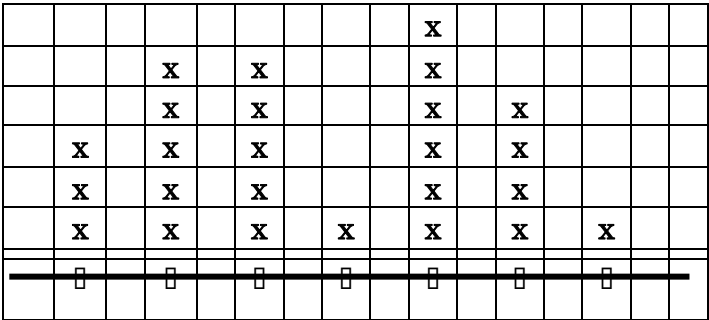
Name _____

Date _____

Graph Analysis Sheet

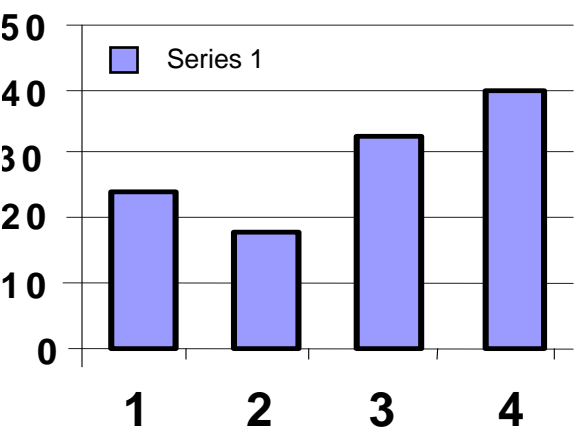
DIRECTIONS: With your partner discuss what each graph could be used for, and provide a possible title for this graph in the space next to the graph.

A.



A.

B.



B.

C.

6	0	2	3		
5	4	5	6	6	
4	1	1	1	9	
3	0	0	2		
2	7	8			
1	1	3	3	4	

C.

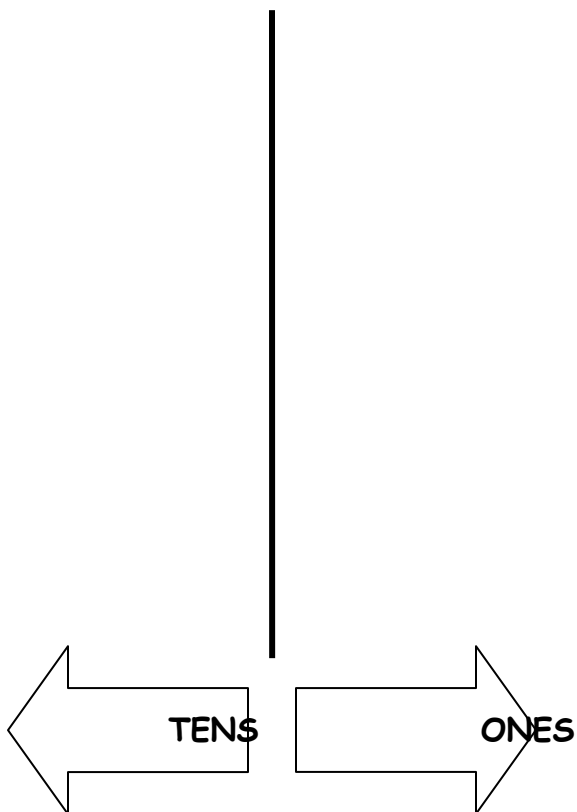
Name _____

Student Resource 7

Date _____

Stem and Leaf Plot

Title



Don't forget...Tens are
the stems, and Ones
are the leaves!

Name:

Date:

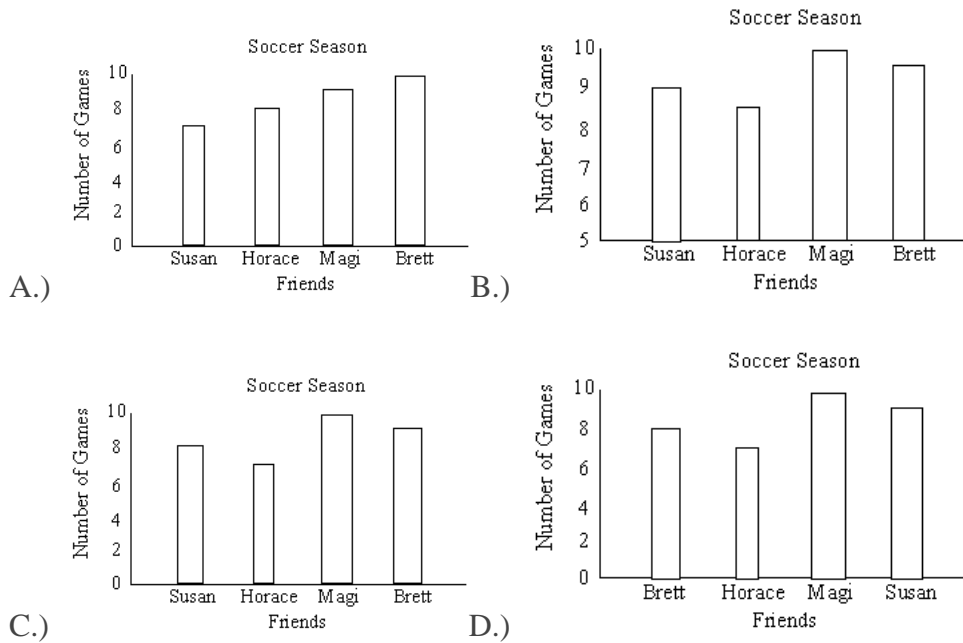
Summative Assessment

Selected Response Questions: Circle the letter of the correct answer in the following questions.

1.) Darryl asked his friends how many games they played during their soccer season. His results are shown below.

Susan - 8 Horace - 7 Magi - 10 Brett - 9

Which bar graph correctly shows the data?



2.) Rosalie measures the temperature for 8 days in a row. The temperatures are shown below.

70° 60° 75° 72° 68° 71° 66° 62°

What is the mean of her data set?

- A. 62°
- B. 67°
- C. 68°
- D. 69°

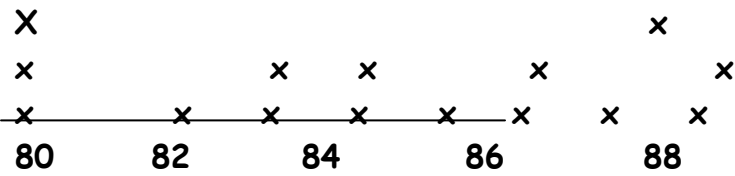
3.) The number of cars sold over many weeks are shown below.

24	17	32	41	28
9	42	36	19	18
28	14	17	31	11

Which stem and leaf plot correctly shows the number of cars sold?

- A. **Cars Sold**
- | | | |
|---|--|-------------------------------|
| 1 | | 1 4 7 7 8 9 |
| 2 | | 4 8 8 |
| 3 | | 1 2 6 |
| 4 | | 1 2 2 4 = 24 cars sold |
- B. **Cars Sold**
- | | | |
|---|--|-------------------------------|
| 0 | | 9 |
| 1 | | 1 4 7 8 9 |
| 2 | | 4 8 |
| 3 | | 1 2 6 |
| 4 | | 1 2 2 4 = 24 cars sold |
- C. **Cars Sold**
- | | | |
|---|--|-------------------------------|
| 0 | | 9 |
| 1 | | 1 4 7 7 8 9 |
| 2 | | 4 8 8 |
| 3 | | 1 2 6 |
| 4 | | 1 2 2 4 = 24 cars sold |
- D. **Cars Sold**
- | | | |
|---|--|-------------------------------|
| 0 | | 9 |
| 1 | | 1 4 7 7 8 9 |
| 2 | | 4 8 |
| 3 | | 1 2 6 |
| 4 | | 1 2 2 4 = 24 cars sold |

BCR:
Cindy's last 15 math scores are shown on the line plot below.



Part A: Which two scores did Cindy receive most often?

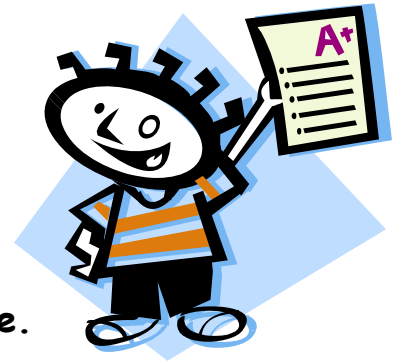
Part B: Explain how you got your answer in Part A. Use what you know about interpreting and analyzing data in your explanation. Use words, data, and/or symbols in your explanation.

Name _____

Date _____

DIRECTIONS: Read the word problem below and answer in the space provided.

Your teacher is trying to figure out your final grade for math class this quarter. You have five assignments scored in the teacher's grade book. You have received a 94, 82, 100, 71, and 88 as your grades. Find the *mean* of these scores to determine your final math grade.



Workspace

$$94 + 82 + 100 + 71 + 88 = 435$$

$$435/5 = 87$$

Letter Grade Key

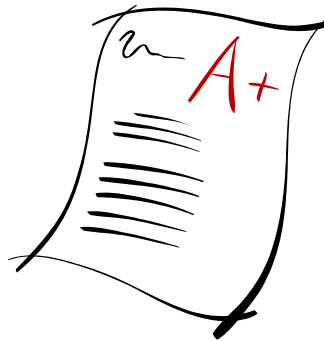
A= 100-90

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E= below 65



Conditional Extension:

If the teacher dropped the lowest grade, what would the new *mean* be?
Would the final letter grade change?

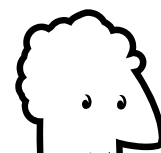
$$94 + 82 + 100 + 88 = 364 \qquad 364/4 = 91$$

Yes, the grade would change from a B to an A

Vocabulary Definitions

Create the vocabulary flip chart with construction paper or use the template created below.

Mean	<p>Average. To find mean add all the numbers in a set of data, and divide by how many numbers there are.</p> <p>Ex. 1, 2, 3, 4, 5, 6, 7, 8, 9 $1+2+3+4+5+6+7+8+9 = 45$ $45/9 = 5$ Mean = 5</p>
Median	<p>Middle, point of central tendency. This number is the middle number in a given set of chronological data.</p> <p>Ex. 1, 2, 3, 3, 5, 6, 7, 8, 9 The median is 5 because it is the middle number in this set.</p>
Mode	<p>Most occurs most frequently. In a set of data this number would be seen most often. There can be more than one mode.</p> <p>Ex. 1, 2, 3, 3, 5, 6, 7, 8, 9 The mode is 3.</p>
Range	<p>The difference between the largest and smallest number in a set of ordered data.</p> <p>Ex. 1, 2, 3, 3, 5, 6, 7, 8, 9 The range is 8, because $9-1=8$.</p>



“How Old is Your Mom?”

Stem and Leaf Introduction

Overview:

Introduce the statistical concept of line plots by quickly surveying the class. Pose the question to the whole class, “How old is your mom?” The students who know their mother’s age will raise hands to share their responses. Record all the mothers’ ages on the board in random order. Once all students have shared their mother’s age, lead the students in organizing the data in chronological order. Finally, those numbers will be arranged in a stem and leaf plot based on their chronological order (see example below).

Instruction:

Stem and leaf plots are to organize many pieces of data that have many numbers close in range. For example, mothers’ ages (22, 28, 29, 30, 34, 37, 37, 40, 41, 42) would be organized by separating tens and ones place value:

2	2 8 9
3	0 4 7 7
4	0 1 2

The “stem” is the tens place, on the left. The “leaves” are the ones values, on the right, “stemming” from the tens value.

Answer Key to the Summative Assessment:

Selected Response Questions:

- 1.)C
- 2.)C
- 3.)C

Brief Constructed Response Answer:

Part A: 80, 86

Part B: I looked at the scores on the line plot and knew that each "x" represents one math score. I then saw that Cindy had three scores for both 80 and 86 that was more than any of the other scores.